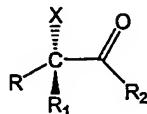
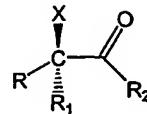


**Claims**

1. A process for the catalytic asymmetric synthesis of an optically active compound of the formula (1a) or (1b)



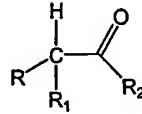
5 (1a)



(1b)

10 wherein R is an organic group; X is halogen; R<sub>1</sub> and R<sub>2</sub> which may be the same or different represents H, or an organic group or R<sub>1</sub> and R<sub>2</sub> may be bridged together forming part of a ring system; R and R<sub>2</sub> may be bridged together forming part of a ring system; with the proviso that R and R<sub>1</sub> are different and R<sub>2</sub> when different from H is attached through a carbon-carbon bond, comprising the step of reacting a compound of the formula

(2)



(2)

15 with a halogenating agent in the presence of a catalytic amount of a chiral nitrogen containing organic compound.

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2. The process according to claim 1 wherein R<sub>2</sub> is H or an optionally substituted C<sub>1-10</sub> alkyl group or R and R<sub>2</sub> are bridged together forming part of a ring system.

20 3. The process according to claim 1 or 2 wherein R<sub>1</sub> is H or an optionally substituted C<sub>1-10</sub> alkyl group.

4. The process according to any of the preceding claims wherein R is an optionally substituted C<sub>1-10</sub> alkyl group, an optionally substituted C<sub>2-8</sub> alkylene group or a C<sub>1-3</sub>-alkylaryl group.

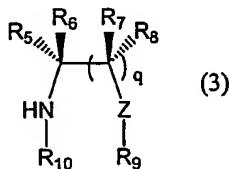
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5. The process according to claim 4 wherein R is an optionally substituted C<sub>1-6</sub> alkyl group, an optionally substituted C<sub>2-4</sub> alkylene group or a C<sub>1-2</sub>-alkylaryl group.

6. The process according to claim 4 or 5 wherein R<sub>1</sub> and R<sub>2</sub> are H.

7. The process according to claim 1 wherein the chiral nitrogen containing organic compound is selected among compounds having a primary or secondary nitrogen atom or when appropriate in one of its salt forms.

8. The process according to claim 7 wherein the chiral nitrogen containing organic compound is selected among compounds of the formula (3)



wherein q is 0 or 1;

R<sub>5</sub>, R<sub>6</sub>, R<sub>7</sub>, R<sub>8</sub>, which may be the same or different represents H, alkyl, haloalkyl, alkoxy, OH, amino, amide, silyl, silyl ether, COR<sub>11</sub>, optionally substituted aryl, an optionally substituted heterocycle, alkyl substituted with at least one OH group, an optionally substituted amino group or optionally substituted aryl or heterocycle or R<sub>5</sub> and R<sub>6</sub> together or R<sub>7</sub> and R<sub>8</sub> together may represent a carbonyl group or when q is 1, R<sub>5</sub> with either R<sub>7</sub> or R<sub>8</sub> may be bridged together forming part of a ring system; R<sub>11</sub> represents an optionally substituted amino group or OR<sub>12</sub> wherein R<sub>12</sub> represents H, alkyl or phenyl;

20 R<sub>9</sub> and R<sub>10</sub>, which may be the same or different represents H, alkyl, OH, or alkoxy; or R<sub>9</sub> and R<sub>10</sub> may be bridged together forming part of a ring system;

Z is S, O, C=O, C(R<sub>14</sub>)<sub>2</sub>, N-R<sub>14</sub> wherein R<sub>14</sub> is R<sub>5</sub>;

with the provisio that the groups R<sub>5</sub>, R<sub>6</sub>, R<sub>7</sub>, R<sub>8</sub>, R<sub>9</sub>, R<sub>10</sub>, R<sub>14</sub>, and Z are selected so that the compound (3) is a chiral compound.

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9. The process according to claim 8 wherein q is 1; R<sub>5</sub>, R<sub>6</sub>, R<sub>7</sub>, R<sub>8</sub> which may be the same or different represents H, COR<sub>11</sub>, optionally substituted aryl or methyl substituted with at least one of the following, an OH group, an optionally substituted amino group or an optionally substituted aryl or heterocycle group; or R<sub>5</sub> and R<sub>7</sub> together represents a C<sub>3-5</sub>

alkylene bridge;

R<sub>11</sub> represents OH, NH<sub>2</sub> or NH-alkyl;

R<sub>9</sub> and R<sub>10</sub> are H or R<sub>9</sub> and R<sub>10</sub> together represents a methylene bridge optionally substituted with phenyl, benzyl, COOH or CO-alkoxy;

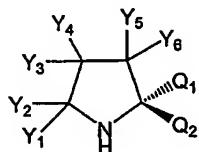
5 Z is CH-R<sub>14</sub> or N-R<sub>14</sub> wherein R<sub>14</sub> represents H or alkyl.

10. The process according to claim 9 wherein either R<sub>5</sub> or R<sub>6</sub> represents H; R<sub>7</sub> and R<sub>8</sub> represents H; R<sub>9</sub> and R<sub>10</sub> together represents a methylene bridge and Z is CH<sub>2</sub>.

10 11. The process according to claim 3 wherein R<sub>1</sub> is H and R and R<sub>2</sub> each represents an optionally substituted C<sub>1-10</sub> alkyl group or R<sub>2</sub> together with R forms an optionally substituted C<sub>3-5</sub>-alkylene bridge optionally with one or more of the carbon atoms being replaced by a heteroatom.

15 12. The process according to claim 1 wherein one or more acids are added to the reaction media.

13. The process according to claim 8, wherein the compound of formula (3) is a compound of formula (4)



(4)

20 wherein Y<sub>1</sub>, Y<sub>2</sub>, Y<sub>3</sub>, Y<sub>4</sub>, Y<sub>5</sub>, Y<sub>6</sub> which may be the same or different represents H, an alkyl, haloalkyl, an aryl, an alkylaryl, a heterocycle, a halogen, a hydroxyl, a carbonyl, an alkoxy, an ester, an amine, an amide, a silyl, a silyl ether, or Y<sub>2</sub> and Y<sub>3</sub> or Y<sub>4</sub> and Y<sub>5</sub> may be bridged together forming part of a ring system one of Q<sub>1</sub> and Q<sub>2</sub> represent H, alkyl, haloalkyl, alkylaryl and the other the group CY<sub>7</sub>Y<sub>8</sub>(OY<sub>9</sub>) wherein Y<sub>7</sub> and Y<sub>8</sub> which may be the same or different represents alkyl, haloalkyl, an alkylaryl, a heterocycle, or optionally substituted aryl and Y<sub>9</sub> represents a silyl group.

14. A compound of the formula (4) as disclosed in claim 13.

15. The compound according to claim 14, wherein  $Y_1$ ,  $Y_2$ ,  $Y_3$ ,  $Y_4$ ,  $Y_5$ ,  $Y_6$  each represents H; one of  $Q_1$  and  $Q_2$  represents H;  $Y_7$  and  $Y_8$  each represents an optionally substituted aryl group, wherein the substituents are selected among alkyl and haloalkyl;  $Y_9$  represents tri-alkyl silyl.

16. The compound according to claim 15, wherein  $Y_7$  and  $Y_8$  each represents 3,5-di-trifluoromethyl phenyl and  $Y_9$  represents trimethyl silyl.

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17. The compound according to claim 15, wherein  $Y_7$  and  $Y_8$  each represents 3,5-di-methyl phenyl and  $Y_9$  represents trimethyl silyl.